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Slow Food: From Farm to Healthy Body

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SLOW FOOD: FROM FARM TO HEALTHY BODY

by

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Abstract

Slow Food is a movement devoted to the preservation and promotion of personal, environmental and community health through lifestyle changes which focus on good, clean and fair food. Good refers to food that is healthy and nutritious for the body. Food grown sustainably as in organic agriculture contains higher levels of beneficial compounds such as vitamins, minerals and phytochemicals. Clean food contains no toxic or harmful compounds that can cause detrimental effects on health. Pesticides and other chemicals are often used in food production; as a result they are found in the final product and are often detected in the surrounding environment. Organically produced food includes many practices that allow it to fit into the Slow Food model. Included in these are, the increased presence of phytochemicals, vitamins and other nutrients as well as decreased concentrations of pesticide residues. Additionally, cover cropping and use of manures improves soil quality for future crops. Fair includes food that economically benefits the producer and the community. Local food systems, cohesively fit into the Slow Food model and help improve the society, economy, and environment of the community. Thus Slow Food is a sustainable model, which if implemented in a community would greatly benefit the health of the citizens, environment and economy.

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Introduction

Slow Food was founded in 1986 by Italian journalist Carlo Petrini, as the antithesis of fast food. Petrini believed that the "fast life" was damaging 20th century citizens and deteriorating their health. People around the world were adopting diets that were detrimental not only to themselves, but to their environments and their communities. The community no longer supported farmers and producers of specialty or heirloom goods and as a result, many of these goods were on the brink of extinction (International, 2012). Also key to the movement was the *defense of and right to pleasure.* Petrini observed that people were losing the ability to truly enjoy food, from growing their own produce to cooking a meal and savoring it to the last bite. Even though eating is crucial to survival but the Slow Food Model supports that humans have a right to more than survive. There is so much pleasure to be had in all the aspects of food. Slow Food is not only about eating; it encompasses a lifestyle that is enjoyable, pure and just (International, 2012).

Slow Food has evolved over the past 25 years to be more than just a set of principles and ideals. The organization runs multiple campaigns around the world, continually taking a more politically and socially active role in the food community. Included in their movements is the Arc of Taste, designed to preserve endangered or rare plant species, animal breeds and knowledge from every region of the world. Additionally, Slow Food has expanded through the establishment of

Terra Madre, a movement designed to point out the injustices that exist in food systems and celebrate local community's connection to food (International, 2012). This brought to light the concept that food justice went beyond taste properties to include respect for the environment and fair pay for food producers (Petrini, 2012). The three principles created by Slow Food are;

Good, whichrefers to the principle that food should be enjoyable and tasty to eat (Petrini, 2012). Over processed, mass produced foods are not foods that people truly enjoy. While it is true that not all people have the luxury of worrying about whether they enjoy their food or not, it should be a goal that all people strive for. Food does not have to be extravagant to be truly enjoyed. According to the Slow Food model, food simply needs to be composed of real, whole ingredients and prepared with joy in mind (Petrini, 2012). Food that fits into this category has been shown to contain higher levels of phytochemicals such as anthocyanins and total phenolics, vitamins such as vitamin C and minerals such as iron and phosphorus and is therefore nutritious (Asami, 2003; Caris-Veyrat, 2004; Faller, 2010; Benbrook, 2003) Wholesome food can be therapeutic and nurture both body and mind (Petrini, 2012).

Clean is the Slow Food principle that deals with contamination of food and the environment. Use of chemical fertilizers and pesticides is proven to have adverse health and environmental effects. Residues from the chemicals used in agriculture are in the food we consume and in the environment in which we

exist(Reganold, 2010). Clean food is produced without synthetic pesticides and fertilizers and so has a much lower impact on the environment and human health. Farmers who practice *clean* agriculture strive for sustainability in the food supply and in the environment (Petrini, 2012). Issues such as topsoil degradation, groundwater pollution, and destruction of ecosystems have all been attributed to the use of chemical fertilizers and pesticides (Gomiero, 2011; Larson 1997; Loewy, 2011).

Fair food describes the need for proper compensation for farms that produce the food the world consumes. Farmers around the world work incrediblyhard to produce food, and are often times unfairly compensated. The Slow Food model is centered on the principle that without the producers of our food, we as a race, would not thrive. It only makes sense to support and properly compensate farmers around the world. The fair principle also ensures that the consumers can reasonably attain enough food to sustain themselves. Due to a lack of support of organic subsidies, price premium exists with organic food(Greene, 2009). Slow Food supports removing that as a barrier to anyone who wishes to eat healthy (Petrini, 2012). As a whole, the motto of fair supports and protects the economics of the food system, by protecting the farmer and the consumer.

Today, Slow Food still represents all of those core values but has morphed into a social and cultural force. Although it is an international organization, representing 140 countries, Slow Food is based upon local volunteers who

individually shape each chapter (International, 2012).Carlo Petrini's view of eating and living is not a new one, but rather one we have lost over many years of industrialization and modernization. However, the Slow Food model is not about moving backwards. It is designed to use the knowledge we have from the past and present to move forward towards a society that is conscious and appreciative of the food system (International, 2012; Petrini, 2012).

Slow Food envelopes a wide range of philosophies surrounding food production, distribution and consumption. Most importantly, it approaches eating as a philosophy instead of as a means for survival. Key Slow Food movement principles include a good, clean and just food system built on regenerative local agricultural production, seasonal vegetable and fruit consumption, and equitable conditions for workers and prices for producers. The benefits of these practices to human health are not completely understood, howeverit has been shown that organically produced food contains not only superior nutrient quality but also decreased levels of pesticide residues and toxic fertilizer compounds (Costello, 2007). Research has shown higher vitamin and mineral content in organically produced food, and these in the right amount and balance have been proven to decrease the risk of chronic disease (Thompson, 2009). This thesis seeks to utilize current research findings to show that the Slow Food model, if implemented in a community, could significantly improve the health of its citizens. Addressing each of the three principles will lead to a healthy body, environment and community.

Chapter 1: Good

Nutrient and Non Nutrient Quality

Phytochemicals, vitamins, and minerals are examples of antioxidants, which are present in many fruits and vegetables and have a highly beneficial effect on health. Antioxidants are nutrient and non-nutrient compounds that bind free radicals, which are produced by normal metabolism. Unbound, these free radicals have the potential to be harmful to cells in the body (Prior, 2013; Gordon, 2012). The medical community has long accepted their contribution to disease prevention(Prior, 2013).Diets containing adequate levels of antioxidants, vitamins and minerals are shown to lower cholesterol and decrease risk for heart disease and stroke (Olson, 1995; Agarwal, 2000). Those present in foods cultivated using the organic method can have higher levels and increased bioavailability. This method of cultivation has a great effect on the compounds present in the final nutrient density. Organic production results in more natural stresses on plants during their growth, a crucial occurrence for the production of secondary metabolites (Mitchell, 2007). When plants undergo such stresses, they react by producing defensive compounds. Secondary metabolites form during the ripening process, and because organic produce ripens at a slower rate than conventional agriculture, they contain higher levels of these compounds (Ginder-Pedersen, 2003). Numerous factors in agriculture such as climate, soil composition, geographical location and time, have a profound effect on the final produce. Crinnion et al. (2010) suggested in their analysis of the current literature, that these factors are

often forgotten when studies are conducted on organic vs. conventional products. Specifically, it has been observed that organic agriculture produces increasing levels of beneficial nutrients and non-nutrients over a time period of 10 or more years. This is significant because, many of the studies have not shown benefits when the organic production history was shorter. (Crinnion, 2010). Thus, elevated levels of vitamins and minerals in fruits and vegetables could exhibit many positive health benefits for humans(Prior, 2013).

A. Vitamins and Minerals

Vitamins and minerals cover a host of functions including but not limited to: transport and increased absorption of other micronutrients, structural components, and coenzyme function. Vitamins also function as phytochemicals and are produced in the plant as protective mechanisms. Caris-Veyrat et al. (2004) found that organically produced tomatoes can have significantly higher lycopene, B-carotene, vitamin C, rutin and naringenin, all of which exhibit antioxidant activity (Caris-Veyrat, 2004). A study by Reganold et al. (2010) found that ascorbic acid (vitamin C) was in significantly higher concentrations in organic strawberries (Reganold, 2010).

In a study completed on organic and conventional groundnuts, cashews and almonds, it was determined that the difference in nutrient content was significant. It was documented that organic groundnuts and almonds contain significantly higher amounts of potassium, iron and calcium (Venkatasubramanian, 2011).

While some vitamins function as antioxidants, numerous other vitamins and minerals perform functions crucial to the body's health. The meta-analysis completed by Hunter et al.(2011) compiled data from 66 different studies conducted on the micronutrient content in organic and conventional produce. They concluded that the cultivation method has a major influence on the vitamin, mineral and trace element content in the produce. Additionally, the study revealed that the levels of vitamin C, phosphorus and total micronutrient content were significantly higher in organic produce (Hunter, 2011).

The vitamin and mineral content of produce is directly dependent on other compounds that exist in the plant while it is growing. Herencia et al. (2011) determined that due to their fertilization regiments, conventional crops contained a significantly higher concentration of nitrogen. While this means the crops will have higher protein levels, they do not contain amino acids in the correct proportions or are missing one or more of the nine essential amino acids so the proteins are not complete. While a greater number of the nine essential amino acids than conventional ones,the presence of excess nitrogen discourages the formation of helpful compounds such as vitamin C(Herencia, 2011).

The study performed by Asami et al. (2003) examined organic and conventionally produced marionberries, strawberries and corn. They detected significantly higher vitamin C as well as total phenolics. Like many others, they

determined that the natural process a plant goes through to defend itself (in the absence of synthetic fertilizers), produces secondary metabolites such as quercetin and kaempherol. These bioactive compounds modulate many metabolic processes such as inhibition of cancer cell growth, antioxidant activity and inhibition of platelet aggregation (Asami, 2003), (Mitchell, 2007).They also determined that the processing method plays a role in the end product's total phenolics and Vitamin C content.

When studying pistachios cultivated under organic and conventional methods, Akababa et al. (2012) found significantly higher levels of calcium, iron, phosphorus, potassium, and magnesium in the organic samples. This determination clearly demonstrates the impact that organic cultivation methods have on nutrient content because the only difference between the two crops was the cultivation method. The presence of the above compounds in the diet is associated with decreased risk of cardiovascular disease, stroke and many types of cancer (Akbaba, 2012).

Worthington el al. (2011) compared the results of hundreds of research studies through a database and determined that vitamin C, phosphorus, magnesium and iron are nutrients that show the most significant difference between organic and conventional production systems. The researchers concluded that organic produce contains higher levels of all four of the above nutrients over conventional. They also determined the size of the difference between organic produce and

conventional produce for these nutrients. Organic produce exhibited 27% more Vitamin C on average than conventional produce (Worthington, 2001).

As the research above indicated, the difference between the vitamin and mineral content in organic and conventional produce is significant. Specifically with Vitamin C, a known antioxidant, the levels are consistently shown to be highest in organic produce (Worthington, 2001; Asami, 2003; Harencia, 2011). Additionally, higher levels of minerals such as phosphorus and magnesium due to increased soil health with organic agriculture, show organic produce as an overall more beneficial product to the consumer's health (Worthington, 2001).

B. Phytochemicals

Phytochemicals have been known to exert protective mechanisms in the human body including, anti carcinogenic, anti inflammatory and inhibition ofplatelet aggregation (Asami, 2003). Classified as a group of non-nutrient bioactive compounds, they exist in plants as a result of defense mechanisms. Antioxidants include phytochemicals, anthocyanins and total phenolics (Gordon, 2012; Prior, 2013).They are thought to be produced by plants in order to protect themselves and it is suspected that these compounds perform a similar function in the human body (Mitchell, 2007). Specifically, antioxidants are chemical compounds, which bind harmful free radical agents in the body. If allowed to get to excessive levels, free radicals can cause serious damage to the cells in the body and the development of numerous chronic diseases. Oxidative stress –induced

inflammationis associated with the pathogenesis of diseases such as cardiovascular disease, cancer, type II diabetes, and obesity (Thompson, 2009).

Utilizing nutrition as preventative medicine, is a way to ensure the health of citizens in a community. Reganold et al. (2010) completed a two-year study on the physical and nutritional quality of strawberries produced organically vs. those produced conventionally (Reganold, 2010).They assessed the strawberries multiple times over the course of the study for phytochemical composition, mineral content and numerous other factors. They found that organically grown strawberries containted 10.5% more total phenolics than conventional berries (Reganold, 2010).

As Faller et al. (2010) demonstrated in their study, organic and conventional produce, a variety of the organic fruits and vegetables contained higher levels of hydrolysable polyphenols. Specifically, organic fruits such as papaya, mango and tangerines showed significantly higher levels of phytochemicals when compared to their conventional counterparts. It was concluded that certain fruits and vegetables tend to be much higher in polyphenols when organically cultivated (Faller, 2010).

A documented study conducted on carrots and tomatoes by El-Mergawi et al. (2010) was that organic tomatoes tend to have higher levels of lycopene and total phenolics over conventional ones. The increased levels of these compounds

were reflected in their increased antioxidant activity: 227.5 umolTrolox per 100g in organic to 186.3 umolTolox per 100g. Their study also showed that organic carrotsexhibitedhigher levels of total phenolics and Vitamin C (El-Mergawi, 2010).

Mitchell et al. (2007) conducted trials over ten years comparing organic and conventional tomato varietals. They observed a higher concentration of the flavonoids kampferol, narigenin, and quercetin in the tomatoes. These compounds benefit health by protecting against cardiovascular disease, cancer and dementia (Mitchell, 2007). Importantly, the study also noted that the flavonoid levels in the fruits increased with the years of organic farming and that levels increased in the organic samples at a much greater rate than the conventional samples. These differences have been attributed to superior soil quality and organic matter in the organic farming system (Reganold, 2010).

Aldrich et al. (2011) examined six organic broccoli cultivars over a two-year growing period, in order to determine their antioxidant activity. Their results revealed significantly higher levels of total phenolics, antioxidant activity and ascorbic acid content in the organically farmed samples as compared to those conventionally farmed (Aldrich, 2011).

Rossi et al (2008) found when studying organic and conventional tomatoes in Italy, that the phytochemical and heavy metal concentrations were negligible

between the organic and conventional types (Rossi, 2008). This study is exemplary of how variable results can be and evidence as to why more rigorous testing should be completed. Many confounding factors such as cultivar of crop, organic standards used and the type of study conducted which can lead researchers to false conclusions (Benbrook, 2008).

Zhao et al. (2006) conducted a meta-analysis on the phytochemical levels of fruits and vegetables. The studies they included in their data,examined a wide variety of produce such asbroccoli, tomatoes, oranges, and radishes (Zhao X. C., 2006). Overall they found that the majority of studies indicated that organically produced fruits and vegetables contain enhanced levels of phytochemicals. Finally, they concluded that the variability between the study model draws attention to the need for much more research to be done (Zhao, 2006).

Wrzodak et al. (2012) found that beta-carotene levels in carrots were actually higher in the conventionally produced vegetables than in the organic ones (Wrzodak, 2012). This further underlines the need for more research and controlled studies in this area. There are many confounding factors, which can exist in a study on agriculture such as geographical location, time of harvest, organic standards used and cultivar of crop being tested (Benbrook, 2008).In the Wrzodak et al. (2012) study, all of these factors were not addressed and so, their conclusions may not be accurate.

The meta-analysis completed by Brandt et al. in 2011 using over 200 studies focused on vitamin C, and total phenolics in organic and conventional produce. They classified the metabolites based on function, and the studies based on methods. It was detected that overall organic produce consistently contained higher concentrationsof the anitoxidantsvitamin C, anthocyanins, and flavanols. They also observed that the category of "defense-related metabolites" (total phenolics) showed even higher concentrations in organic over conventional produce (Brandt, 2011).

Clearly the cultivation method used on crops has a profound effect on the phytochemical, vitamin and mineral content. Many other factors have the ability to contribute to the final nutrient density in foods. Included in these are: presence of potentially harmful residues, interaction of the nutrients within a product, effects from the environment such as whether organic or conventional production methods are used, and the source of the product. *Local* is a term that is becoming more and more popular in US agriculture. In general it is a term that refers to food that originates from a direct source within a given community. There is no solidified definition of local, but the USDA hastermed local, any food that has traveled less than 400 miles from its origin and recognized the act of direct producer to consumer sales as significant (Martinez, 2010).

Nutritionally, produce that is consumed from the local environment has the potential to be more beneficial to health (Martinez, 2010). Issues such as shelf and

storage life of produce have an effect on nutritional quality as well as ripeness at time of harvest (Vallejo, 2003; Botrel, 2012; Lee, 2000). Additionally, while there is no requirement for local, there does tend to be a high correlation between produce being both local and organic (Martinez, 2010).

Concerns over loss of nutrients and nutrient quality due to long storage periods were addressed in a study done by Vallejo et al. (2003). The authors investigated the effects of storage period and temperatures associated with food traveling long distances. It was determined that under numerous simulated temperatures and times, broccoli experienced significant losses of 71-80% of total glucosinolates, 62-59% of total flavonoids, 51-44% of sinapic acid derivatives, and 73-74% caffeoyl-quinic acid derivatives as compared to the vegetable at harvest (Vallejo, 2003). A similar study done by Theur et al. (2006) demonstrated that strawberries grown with organic agriculture had longer shelf lives and resistance to common spoilage organisms (Theur, 2006).

Botrel et al. (2012) documented in their study on tomatoes that the organic tomatoes have higher levels of vitamin C, regardless of storage time and temperature. They noted that the level of vitamin C increased in the organic tomatoes, from time of harvest until after ten days of storage. Organic tomatoes also presented the highest level of beta-carotene, phenolics and antioxidants. The conventional tomatoes maintained levels for 20 days, but the organic tomatoes showed superior levels up to five days (Botrel, 2012). Based on this research it

could be concluded that organic tomatoes, eaten five or less days after harvest would contain the highest concentration of phytochemicals. If a local food system was in place, this goal could be easily attained.

Differences in the outcome of the multitude of studies conducted on the nutrient and non-nutrient content of organic and conventional produce can be attributed to a variety of things. Design studies that are flawed or skewed have the ability to produce results that are not highly objective. A studycompleted by Benbrook et al. (2008)attempted to examine the data from organic vs. conventional research. They developed 17 criteria to ensure that factors that could confound, mask or skew any real differences in nutrient levels between organic and conventional foods were eliminated. Some of the criteria included, type of crop, organic or conventional treatment, and many others.They also created matched pairs of organic and conventional fields, using factors such as soil type, crop cultivar, study design, organic standards, and years under organic management (Benbrook, 2008). This is significant, because these researchers were able to remove most foreseeable confounders and draw unbiased conclusions. Their findings consisted of 191 matched pairs with valid comparisons of antioxidant, vitamin and mineral levels (Benbrook, 2008). Of the 191, 119 showed higher nutrient levels such as phytochemicals, vitamins and minerals for organic produce or 62%, and 68 showed higher levels in conventional produce or 36% (Benbrook,

2008). This study is significant because it shows how many factors can affect the data that is collected and how it can represent different conclusions.

As demonstrated by the research above, the differences between the phytochemicals in organic and conventional produce is significant. Based on the research collected, it appears that the combination of increased levels of many phytochemicals would clearly benefit the body. Oxidative stress is a major contributing factor to numerous chronic inflammatory diseases (Thompson, 2009). Phytochemicals are crucial to fighting these deleterious effects on the body. As many of the studies conclude, more research is needed to assess the full effect of organic vs. conventional produce on the human body.

In summary, it is clear that a majority of the research collected, concludes that organic produce often contains higher levels of secondary metabolites ie:increased levels of lycopene, beta-carotene, total phenolics and numerous other classes of phytochemicals (Benbrook, 2008; Botrel, 2012; Brandt, 2011) . Studies conducted in this area also point to increased concentrations of vitamins and minerals in organic produce (Caris-Veyrat, 2004; Herencia, 2011; Asami, 2003; Worthington, 2001). Controversy among studies is due to flaws in study design (Benbrook, 2008). However, it must also be stressed that many other variables besides nutrient content go into the overall appeal of food. Included in these are environmental impact, presence of toxins, and social impact. Examining the

overall picture of food allows us to more accurately determine the array of potential interactions it will have in the human body.

Chapter 2: Clean

Two primary methods of agricultural production exist in the United States, the *organic* method and the industrial method, which is most used and termed *conventional*. These two methods differ in the numerous inputs and outputs they rely on. Research concludes that the method in which food is grown has measurable effects on the final product (Gold, 2007; Winter, 2011). These include altered nutrient quantity, presence of pesticide residues, changes in yield and effect on the environment.

A. Organic Agriculture

Organic production methods exclude the use of synthetic fertilizers and pesticides, which can cause the plant to undergo stresses from the environment. These stresses in turn cause the plant to defend itself by producing secondary metabolites such as phenolic compounds, which act as antioxidants. Agricultural practices that are organic tend to focus on good soil health, which promotes the accumulation of numerous beneficial effects. Increased available nitrogen from symbiotic bacteria, improve soil organic matter and decrease soil erosion are among the factors which promote less stress (Gomiero, 2011). Organic farmers are concerned with yield, but they are equally concerned with the state of the environment. The practice of organic agriculture is based on the balance between inputs and outputs of the environment. Organic farming relies on many fundamental agricultural practices such as crop rotation, natural fertilizers and

pesticides, and biodiversity (Gomiero, 2011; Bengtsson, 2005; Benbrook, 2004). The combination of these strategies yields a sustainable system that is focused on environmental health. Good quality soil not only increases the concentration of nutrients present but also increases the populations of beneficial microorganisms. Organic agriculture theoretically yields a product that has been minimally exposed to synthetic pesticides and fertilizers and therefore contains fewer pesticide residues (Gold, 2007).

Several practices in organic agriculture can lead to increased levels of nutrients (Gomiero, 2011). First there is crop rotation, which primarily ensures that the crops do not deplete the nutrients in a given field before the next crop is planted there. Second, the practice of cover cropping decreases the risk that massive soil erosion does not occur in between cultivation periods. This also allows fields to rebuild nutrients and soil structure for a season and gain any nutrients lost during the previous season (Gomiero, 2011). Third, green manures are often planted on the fields that are in rotation. Green manures are crops such as clover or barley that are designed to be plowed back into the field at the end of the season, and add to the organic matter. Finally,organic farming includes the use of compost, a rich substance consisting of decomposed organic matter (Gomiero, 2011). This addition enriches the soil, further increasing the amount of nutrients available to the crops (Worthington, 2001). The combination of these practices allows organicagriculture to produce crops without the use of synthetic fertilizers.

According to the Organic Table Association, more than two thirds of US consumers buy organic foods occasionally and 28% buy them weekly (Greene, 2009). Despite the price premium associated with these foods, U.S. organic consumers are increasing. Organic sales have quintupled since 1997(3.6 billion to 21.1 billion dollars), specifically in the categories of produce and dairy products, which accounts for over half of the gains made (Greene, 2009).

B. Conventional Agriculture

The conventional agricultural practice is based on highest yield in the smallest amount of space, with less focus on environmental impact. Conventional farmers believe that production of food is more important in the short term than preservation of the environment (Gomiero, 2011). This agricultural practice includes the use of USDA approved synthetic fertilizers, and pesticides. Chemical pesticides are applied throughout the plant's life-cycle to deal with pests such as weeds and fungi. Fertilizers are used to enrich the nutrients of the plant and enhance its growth. In the past 35 years use of chemical fertilizers and pesticides has grown nine-fold and thirty-two fold, respectively (Swarainathan, 2010). Due to their ability to increase yield of crops, food production has surpassed the population need of the world (Swarainathan, 2010).

Countless types of fertilizers and pesticides are being used in conventional agriculture today. Bolognesi et al. (2011) identified major groups of pesticides;neurotoxicants such as organocholorides, organophosphates, and

carbamates, disrupters of energy metabolism such as dinitophenols, organotins, and pyrroles, and insect growth regulators benzoylureas (Bolognesi, 2011). These pesticides can exert harmful effects such as acute toxicity from short-term exposure and neurologic, carcinogenic, reproductive and genetic effects due to long-term exposure (Bolognesi, 2011).

Monoculture is the adoption of one single commodity crop on a farm for the purpose of high yield. This practice is one adopted by many conventional farmers that raise crops such as corn, soy and wheat. The use of monoculture undermines the benefits of biodiversity on crop health and development. Biodiversity encourages interspecies competition and natural pest and disease management (Bengtsson, 2005). Biodiversity also ensures that if one crop fails due to disease or weather, the farmer will have a back up crop. Due to the lack of diversity, monoculture can make management of large farms easier and more cost efficient (Bengtsson, 2005). Disadvantages to monoculture include, loss of biodiversity and increased risk for complete loss of crops from disease (Bengtsson, 2005).

The use of genetically modified organisms (GMO) is included in conventional agriculture. This practice has been a part of conventional agriculture since the early 1990s. Genetically modified organisms are designed to be resistant to pests and diseases or to specific chemical agents. The USDA Organic certification process prohibits the use of GMOs (McEvoy, 2012).

Organic and conventional agriculture differ greatly in methods, regulations, and overall philosophy. These differences result in measurable contrasts in the impact that the final product makes on the environment. It is crucial that all aspects of each method are taken into account. Like our health, the food we consume is composed of numerous inputs and outputs that must all be considered to make the best possible choice.

Based on the findings presented above, it is clear that a significant portion of the U.S. population has determined that the benefits of organic foods outweigh its costs (Greene, 2009). However, the majority continues to consume foods produced by conventional methods. This could be due to gaps in education, the increased cost to consumers or lack of concern over health (Oluwole, 2009). The Slow Food Model is designed to improve the health of the individual, the community and the environment. Organic food fits into the model because it is considered *good, clean* and *fair*.

C. Pesticide Residues In Organic and Conventional Foodsand Their Effects on Human Health

Use of herbicides and fertilizers in conventional agriculture has been proven to cause adverse effects from leaching into groundwater and accumulating at dangerous levels (Arias-Estevez, 2008). Overworking agricultural land causes long-term effectssuch as soil erosion, loss of soil organic matter, nitrogen leaching

and many others (Gomiero, 2011). However, the use of synthetic pesticides has allowed advancements in the potential yield of certain crops as well as decreased losses and labor inputs (Witczak, 2012; Swarainathan, 2010). Organic agriculture focuses on preserving the quality of the soil for future generations by implementing such strategies as cover cropping, use of manure fertilizers and approved non-synthetic pesticides (Reganold, 2010). The importance of preserving the soil quality is recognized by countless organizations but actions to ensure its preservation are slow to be realized. The absence of pesticides and fertilizer traces in foods, as seen in the organic method of agriculture, decreases levels of toxins and residues in the foods. Several countries in the European Union have determined the effects of certain chemical fertilizers and pesticides significant enough to ban their use (Witczak, 2012).Due to the fact that pesticides are often applied in combination or as cocktails, it can be difficult to determine which individual agents are associated with specific effects (Leffall, 2010). The future of agriculture is rooted in determining how all of these stresses, affect both the human body and the environment.

Organic agriculture does not prohibit the use of all pesticides but does prohibit the use of synthetic pesticides as well as the use of certain amounts of fertilizers (Martinez, 2010). Because of this, it is generally concluded that organic produce is safer for consumption. Research has shown that produce from organic agriculture contains lower levels of chemical residues from pesticides and fertilizers (Benbrook, 2011; Curl, 2003; Lu, 2006; Witczak, 2011). Additionally,

organic agriculture results in significantly lower concentrations of synthetic fertilizers such as nitrogen or phosphate, in the soil (Martinez, 2010; Benbrook, 2011). Presence of these synthetic materials in the soil is thought to contribute to acidification and water contamination. These were both identified as major concerns for Northern and Western Europe at the United Nations RIO+20 Conference on Sustainable Development (Swarainathan, 2010). Conventional produce consistently contains residues from these pesticides and fertilizers due to their use throughout the agricultural process. The levels present have been determined by some to have little impact on human health (Winter, 2011).These conclusions could be due to data that is not properly obtained, as mentioned by Benbrook et al. (2008).

The results of a systematic review conducted by Smith-Spangler et al. (2012) demonstrated that only 7% oforganic produce contained pesticide residues, whereas 38% conventional contained residues. They also concluded that overall, organic produce had a 30% lower risk of pesticide contamination. Overall however, they determined that their findings did not justify organic foods being labeled “safer” or “healthier” (Smith-Spangler, 2012). This conclusion is based upon theirstrict criteria they choseto use.

Winter et al. (2011) conducted a study on the pesticide concentrations of the Environmental Working Group’s “Dirty Dozen” and found that only a few of the items on the list such as: bell peppers, celery and apples contained

concentrations significantly close to the recommended limits of exposure (Winter, 2011). However, because these levels are compared to a standard developed by the Pesticide Data Program (PDP), it is crucial to further examine which levels of these chemicals are determined to be safe. Recommended limits of exposure are under severe scrutiny by many groups which argue that no levels of exposure are safe (Leffall, 2010).

Cereal grains (rye and wheat), which were conventionally produced, were determined to have significantly more total pesticide content than those produced organically (Witczak, 2011). Overall the organic wheat presented the lowest levels of the 13 different organochlorine pesticides in both the soil and the final product. Cereal grains are widely consumed all over the world and based upon this study, should be an area for concern.

Farmers struggle with pest issues throughout the duration of their planting season. As a result, many choose to use chemical herbicides and pesticides as part of their management programs. This practice is used to make farming less costly and less labor intensive. However, in return the farmer is exposed to numerous hazards with potential deleterious health effects (Ngowi, 2007; Oluwole, 2009, Lu, 2011). Improper use of chemical fertilizers is a serious issue in many developing countries (Swarainathan, 2010). It is obvious that the use of synthetic fertilizers is attractive to the farmers for all reasons mentioned above, but inadequate

knowledge and resources continues to hinder farmers from actually benefitting from their use (Ngowi, 2007; Oluwole, 2009; Lu, 2011).

In many developing countries the application of pesticides is not well regulated and the knowledge level of farmers about their use is low. As a result, the pesticides are often misused (Ngowi, 2007). Ngowi et al. (2007) reported in a review doneof pesticide use in South Africa and Tanzania reported that approximately 41 different pesticides were being applied to local fields. Through a series of questionnaires they found that a majority of farmers were applying pesticides on a regular basis and in some cases as many as 16 times per season. Sixty-eight percent of farmers reported feeling sick after routine application of pesticides. The farmers reported symptoms such as dermal effects, dizziness and headache. Often times the whole family that assisted in maintenance of the farm were exposed and would also be at risk (Ngowi, 2007).

Oluwole et al. (2009) completed a study in Nigeria on pesticide use and its effects on the local population. They observed that the whole family was involved in the farm so they were all exposed on a regular basis to the pesticides. Their study concluded that 91.3 % of farmers reported health-related problems when they sprayed pesticides. Individual farmers reported a minimum of five symptoms including nausea, headache, vomiting, eye irritation and skin problems. Eighty-nine percent also reported that they did not take the proper safety precautions before using pesticides (Oluwole, 2009). Increased education and training on the

safe use of pesticides would benefit the health of both the farmers and their families.

In a study, completed on pesticide exposure in the Philippians, Lu et al. (2011) discovered that three commonly used pesticides were the cause of several health issues. Exposure of farmers and their families to organophosphates, organochlorines and pyrethyroids was linked to reported changes in red cell cholinesterase, muscle fasciculation, conjunctivitis, eye pain, and numerous neurological symptoms (Lu, 2011).

Prolonged exposure to pesticides and fertilizers, or high pesticide exposure events (HPEEE) has been associated with increased risk for depression (Beseler, 2008). The study was conducted by Beseler et al. (2008) using a questionnaire to evaluate farmers in Iowa and North Carolina. Only a small percentage were ever clinically diagnosed with depression, however this was attributed to the fact that many of the farmers could not or would not seek medical care for their problems. The odds for developing depression were significantly increased in those who reported either prolonged exposure to pesticides or an HPEE (Beseler, 2008). Even those who used the proper protective equipment (PPE) were still at risk (Beseler, 2008). The only PPEs found to significantly decrease risk with exposure were the chemically resistant gloves, which all the farmers did not report wearing (Beseler, 2008).

The University of Nebraska publicized a report, which stated that overall, farmers are as healthy if not healthier than the general population (Schulze, 2007). Health was defined by a series of factors such as life span, likelihood of developing conditions like cancer or heart disease and physical activity (Schulze, 2007). They then went on to caution that male farmers have 14% higher chance than the general population of developing prostate cancer especially after age 50. Their report also states an association between lung cancer and certain herbicides and insecticides, as well as increased risk of breast cancer in women married to farmers. The report mentioned a correlation between pesticide application and multiple myeloma and leukemia, respiratory issues, vision, and women's reproductive issues (Schulze, 2007). While farmers and their families have the potential to be very healthy, there is an increased level of risk associated that cannot be ignored.

In a study conducted on the occupational hazards faced by women in Nigeria, Egharevba et al. (2004) concluded that prolonged use of pesticides and other chemical agents was the cause for many health issues. Besides the obvious physical hazards such as heat exhaustion and muscle fatigue, 30% of the women reported skin and respiratory ailments due to exposure of harsh chemicals (Egharevba, 2004).

The report published by the President's Cancer Panel in 2010 reviews all the possible environmental factors that increase risk for cancer (Leffall, 2010). Risk from agricultural sources is recognized as a major concern in the United States. Specifically they identify the increased risk for cancer such as leukemia, among children who grow up on farms or near farms. Additionally children whose parents use pesticides in gardening or children who are pesticide applicators on farms had increased risk (Menegaux, 2006). Increased risk among farmers for prostate cancer in addition to increased risk for female pesticide applicators to develop ovarian cancer is documented. This report also states that exposure to pesticides including herbicides, insecticides and fungicides has been linked to brain and central nervous, breast, colon, lung, pancreatic, kidney, testicular, and stomach cancers (Clapp, 2007). Additionally links have been established between exposure to these agents and Hodgkin and non-Hodgkin lymphoma, multiple myeloma and soft tissue sarcoma (Clapp, 2007). Thousands of pesticides have been approved for use in agricultural and non-agricultural settings, and while the risk is higher amongst agricultural workers, it is still prevalent in the general population (Leffall, 2010).

Leffall et al. (2010) also examined how risk associated with consuming foods that have been exposed to pesticides and fertilizer residues affects human health (Leffall, 2010). Nitrogen is a particular compound of concern because it is a fertilizer used heavily in conventional agriculture and as a result is found in dangerous levels throughout the environment(Vitousek, 1997). Exposure to

nitrogen in excess is linked to many forms of cancer such as brain and ovarian as well as tumor spread and proliferation (Lijinsky, 1986), (Weyer, 2001). Cadmium containing phosphate fertilizers are also widely used and have been strongly associated with pancreatic cancer(Falk, 1988).

When determining the cause of exposure to endocrine disrupting chemicals (EDCs), McKinlay et al. (2008) found that exposure through consumption of conventionally produced foods was among the leading contributors. They also determined that being exposed via involvement in the conventional agriculture practice most likely resulted in harmful exposure (McKinlay, 2008).

Lu et al. (2006) observed in their study done on dietary pesticide metabolites from children on both conventional and organic diets, that the organic diet provides an almost immediate protection against pesticides in food. They examined specifically organophosphorus pesticides in the children's diets over a 5-day span. Even with that short trial period the results show that children on the organic diet had significantly lower pesticide residues in the urine(Lu, 2006). This is especially important for children who consume large amounts of fresh produce and cereal grains, as they are the foods with the highest concentration of pesticide residues.In another study conducted by Lu et al. (2000), results showed that families where one or both parents were involved with agriculture or if the family lived in close proximity to corn fields, had five times the urinary concentrations of organophosphate metabolites (Lu, 2000).

Curl et al. (2003) conducted a study on urinary concentrations of organophosphates (OP) in school children, ages two to five. Urine samples were taken for a 24-hour period three days after beginning their respective organic or conventional diet and were analyzed for five major metabolites of organophosphates. The study revealed that diet was the main avenue for contamination, and that children with organic diets had significantly lower levels of dimethyl metabolites in their urine than children that consumed conventional diets (Curl, 2003).

Another study was conducted by Curl et al. (2002) on organophosphate take-home residues in the children of farmers. They tested samples of dust, inside cars, and urine from both children and farmers in the household. The researchers determined that the pesticide Azinphosmethyl was found in 85% of dust samples and 87% of car samples at levels above the limit of quantitation determined by the EPA. They also detected the pesticide DMPT (Dimethylphosphorothidate)in 88% of child urine samples and 97% of adult urine samples at levels above the limit of quantitation (Curl, 2002).

Risk for exposure to pesticides also exists when residues are present in the produce that is harvested and sold for consumption. Even though farmers sometimes apply pesticides safely, traces are often detected in the final produce. Safe levels have not been fully examined by health professionals, but there is no

doubt that they are present in the food American's consume. Exposure has been linked to numerous cancers,long-term degenerative symptoms such as blindness and numbness of limbs and acute physical symptoms such as fatigue and dizziness.

Clean food is supported by the Slow Food model, and correlates closely with organically produced foods (Gomiero, 2011). Due to the regulations associated with organic production, synthetic fertilizers and pesticides cannot be detected in their products. It could therefore be concluded that, organic produce will expose those who consume it, to much less risk of ingesting contaminants with ultimate effects on health and disease.

Chapter 3: Fair

An important part of eating locally and seasonally is the development of a connection with the land from which the food came. It is well known that the environment has a great influence on our health. Relationships with food are developed at a young age and are carried throughout life (McAleese, 2007). The overall positive effects of a healthy relationship with food can lead to lasting mind, body and societal benefits. With the knowledge to make informed choices, people tend to make choices that improve their health. Attitudes towards the food system can greatly influence how people choose to eat, and it has been shown that those who invest in a sustainable food system make healthier food choices(Morland, 2002). Economically, buying organic and local foods can be more costly but if one invests in their health and community,they are benefiting that community and therefore themselves. Buying local and organic allows the society to improve the health and well being of its citizens. The environment is improved by a local, organic food system due to improvements inthe air, soil and water quality.This systems approach to health ensures that the effects are holistic and benefiting the individual, society and the environment.

A. Economy

A local and organic food system could stimulate local economies in numerous ways. Direct contact between the farmer and the consumer cuts out the "middle man" and allows the farmer to gain more of the direct profit (Lea, 2005).

Farmers who are able to sell their goods within the local community return the money to the community and therefore have the potential to boost the economy. As Lev et al. (2003) determined in their report on small farms in Oregon, citizens who shop at famers markets placed in the town center also spent money at other neighboring vendors (Lev, 2003). So, instead of spending their money all at one or two national supermarkets, consumers are supporting several small businesses that will in turn support the local economy.

The idea of money staying within a community can be difficult to identify. However, a study was conducted in Iowa, which estimated that every dollar spent at farmer's markets resulted in¢0.58 in indirect spending. Otto et al. (2005) estimated that each dollar the farmers earned at the market resulted in ¢0.47 in indirect income (Otto, 2005). The value of this finding is critical to the strength of locally maintained economies. If communities can be self-reliant, they are significantly more stable and resilient to disaster. They have the ability to deal with issues on their own instead of relying on outside forces.

Those who chose to purchase organic foods on a regular basis have differing motives including health, ethics and the environment (Driouech, 2011). In a study,which looked at why Serbian adults chose organic or sustainable foods, it was discovered that cost was low on the list. Seventy-one percent connect ethical values with respect of the environment, 35% chose sustainable "agro-foods" because of improved quality, 17% because of the organic certification and 15%

because of taste (Driouech, 2011). This means that those who purchase organic or sustainable foods on a regular basis are not concerned with the cost, but are investing in their health and the health of their environment.

In only the past 30 years, since the start of intensive, conventional agriculture, substantial damage has been done to the environment and to the citizens that inhabit it (Swarainathan, 2010). There is reason to believe that continuing with conventional agriculture will lead to further destruction that may not be reversible. Organic agriculture as part of a local food system has the potential to stabilize the future through sustainable development. Adoption of organic agriculture can be economically viable, because while the yields are often lower than conventional, consumers are willing to pay premium for the healthier foods (Kaswan, 2012). Additionally, if more focus were placed on organic agriculture, and government subsidized organic agriculture research could reveal ways to increase the economic viability beyond that of conventional agriculture.

B. Society

Research has shown that the availability of food in the average American's neighborhood has a direct effect on their health (Morland, 2002). In their study of the local food environment and its citizens' diets, Morland et al. (2002) revealed that fruit and vegetable intake increased by 32% in black Americans and 11% in white Americans with the presence of one or more supermarkets (Morland K. W., 2002). Local food systems are clearly crucial to the diets of its citizens. The

healthierfood that is available, the greater number of people will have the choice to consume it. Research also indicates that participation in Community Supported Agriculture (CSA) results in positive changes in diet such as increased consumption of fruits and vegetables (Lea, 2005).

Recently, there has been a trend in the United States towards the utilization of gardening as a teaching tool in schools (Vallianatos, 2004). All over the country, schools are adopting school gardens to teach children the connection between cultivation and diet (McAleese, 2007). Many garden programs have been able to produce food to be served in the school cafeterias. School is a substantial part of children's lives and so it has been determined that a school is the environment which can have the most influential impact on them. They are influenced by what they learn and what is available for resources there. The National School Lunch Program (NSLP) is the standard in U.S. Schools (Vallianatos, 2004). Although NSLP is designed to be balanced for children, in practice, it has not always proven to be effective. There is a whole generation of children who grew up with no knowledge of how to shop, plan or prepare a meal. As a result, they have very little respect for the food system or how much they are affected by its failures.

Eating patterns learned as children are carried into adulthood (McAleese, 2007). This, in combination with other factors has led to the obesity epidemic among both adults and children in the U.S. McAleese et al. (2007) discovered that

sixth-grade students who participated in garden-based nutrition education increased their servings of fruits and vegetables more than those who just received nutrition education. Children who are taught where their food comes from at a young age are more likely to carry this knowledge throughout their lives (Vallianatos, 2004).

Losses of important nutrients in foods stored for long periods of time and at abnormal temperatures could be remedied by the adoption of a local food system. Research has shown that storage temperatures required to keep produce from spoiling, causes losses in nutrients such as glucosinolates and flavonoids (Vallejo, 2003). However, if farmers are harvesting produce and then selling to the consumer later that day, the nutrient losses would be much lower. This also allows the produce to ripen on the plant versus ripening in a truck or on a plane which increases the nutrient density (Vallejo, 2003).

Food deserts, urban areas with no access to a grocery or produce store, exist in increasing numbers in the United States. Those who live in these areas can be disadvantaged if they do not possess means of transportation to the grocery stores. Families are forced to shop at convenience stores, which generally have a very poor selection of nutritious foods. A study was conducted that revealed increased BMI in those who shopped for groceries in disadvantaged neighborhoods (Inagami, 2006). The findings reveal that there is a relationship

between socioeconomic status and health. Additionally, it further underscores why a local food system is so crucial to health.

A study was conducted on the prevalence of obesity as related to the presence of grocery stores. The presence or absence of fast food chains and franchised restaurants directly affected body mass index (BMI) of the subjects (Morland K. B., 2009). Specifically, areas with at least one grocery store observed a decrease of 0.73 in BMI and areas with at least one limited service restaurant or one specialty foods store were associated with lower BMIs (Morland, 2009).

A study was completed by Moore et al. (2008) to investigate how three criteria of local food environments affected the health of the citizens. The criteria were; supermarket density, participant-reported assessments, and aggregated survey responses of independent informants. The researchers found that participants with no supermarkets within one mile of their home were 25% less likely to have a healthy diet as compared with those who had the most stores near their homes. They also observed that participants in the areas ranked worst in food availability, were 22% to 35% less likely to have a healthy diet than those in the best-ranked areas (Moore, 2008).

Farmer's markets are common ways in which local foods reach consumers. Public health benefits including increasing community access to fresh fruits and vegetables, and encouraging physical activity and social interaction were identified

in Hershey Pennsylvania by George et al. (2011) Decreasing the presence of "food deserts," or areas in rural or urban locations where groceries are not easily accessed, was another goal of the researchers in implementing an organic farmers market (George, 2011).

It is clear from the above studies that local organic food has a major impact on the health of societies. Humans are social creatures and are intimately affected by their social interactions (George, 2011). A substantial portion of learned behaviors are observed from the people who are closest to us (George, 2011; Moore, 2008). Additionally, many people are confined to their community due to lack of transportation, income or time. As a result, these citizens have limited access to the food system of their community, which often lacks any sort of grocery store or farmer's market. It is critical to the health of the citizens of aforementioned communities that local food systems are developed to support them.

C. Environment

Agriculture naturally has an altering effect on the environment but the extent of the impact is determined by the practices used (Greene, 2009). Organic agriculture strives to increase the yield of crops while improving the quality of the soil environment. Soil health can be defined as the capacity of soil to sustain

biological productivity, environmental quality and promote plant and animal health (Holden, 2000).

As previously mentioned in this thesis, synthetic pesticides and fertilizers are prohibited in organic agriculture. Their detrimental effects on the human body were discussed extensively in previous sections, but the effects on the environment have not yet been addressed. Leaching of fertilizers such as nitrogen fertilizer, which is required for many commodity crops, is prevalent in conventional agriculture (Gomiero, 2011). Nitrous oxide (N_2O) is a powerful "green house gas" which is three hundred times as effective at radiative warming than carbon dioxide (CO_2). Nitrous oxide is created by microbial de-nitrification, which increases with the amount of available soil nitrogen. Nitrogen is present in higher amounts in conventional fields due to the use of nitrogen fertilizers (Gomiero, 2011).

It was determined in London that, purchasing apples and importing them resulted in seven times greater carbon dioxide pollution that from local sources (Lea, 2005). This is due to increased "food miles" or approximate miles that is; miles food travels from site of production to site of consumption. This estimate also includes energy consumed from transportation of the goods via plane, truck etc.

Soil organic matter (SOM) is crucial to plant health and is naturally eroded and degraded over time by agriculture (Gomiero, 2011). Farming practices such as

cover cropping and crop rotation help to preserve and restore SOM. Organic farming includes all of these practices and has been proven to maintain SOM in the long term. Soil managed with organic practices had 16 more centimeters of topsoil than conventional and <75% soil loss as compared to the maximum tolerance value in the region. Conventional soil reported as much as three times the maximum tolerance value for soil loss in the region (Gomiero, 2011).

With the ever-growing world population, sustainable nutrition is becoming more crucial (Wahlqvist, 2005). A large percentage of the world's citizens are malnourished, and although more a nutritious crop that is disease resistant may seem like the solution, it isnot sustainable (Wahlqvist, 2005).We know that there are negative effects on the environment as a result of these crops such as pesticide resistant insects. This question still remains to be answered by the next generation of scientists and food consumers.

Loss of biodiversity is a major concern for many supporters for organic and sustainable agriculture (Bengtsson, 2005). Organic agriculture has been shown to support significantly higher biodiversity by about 30%. This biodiversity was classified by presence of species such as birds, insects, soil organisms, crops, and other plants on the farm(Bengtsson, 2005). These organisms not only have a beneficial, symbiotic effect on the environment, but also contribute key aspects to agriculture. Pest control can be achieved by the presence of biodiversity via use of trap crops in which a crop known to be attractive to a certain insect is planted near

the “cash crop” to divert the insect (Bengtsson, 2005). Soil organisms achieve nitrogen fixation, and biodiversity also lends to the variety of root structures, which in turn support the strength of the soil (Gomiero, 2011).

Farmers in India who routinely use pesticides on their crops reported observations of decreased soil fertility, decreased water quality, increased drought, loss of biodiversity, contamination of the ecological food chain, air pollution, adverse effects on beneficial soil organisms as well as pollinators, and predators (Sharma, 2011).

Pesticides and fertilizers enter the water supply via leaching and run-off from the soil of agricultural fields. In a comprehensive study done by Arias-Estevez et al. (2008) on the mechanisms by which pesticides are degraded and transported through soil, it was concluded that the process is highly complex. They determined that currently there is not enough knowledge about the fate of these potent chemicals to be using them as liberally as conventional agriculture does (Arias-Estevez, 2008).

Use of chemical pesticides and fertilizers lead to 95% of streams, and 50% of wells exhibiting at least one pesticide in a US geological survey in 1999 (Robert, 1999). Additionally, the Environmental Protection Agency (EPA) reported presence of 46 pesticides in ground water samples and 76 pesticides in surface water in 1997 (Larson, 1997). These findings are dated and should be

reproduced to determine if the issue has worsened due to increased agricultural activities or decreased due to new regulations.

In Argentina, three commonly used pesticides were tested in ground water before, during and after the growing season (Loewy, 2011). Before the first application of the season, pesticide residues were detected in the soil, and although they were a fraction of those observed during the growing season, their presence proves that the residues were most likely still in the water from the previous season. During the growing season, significant levels of the three studied pesticides were detected in the water. The presence of these residues was attributed to the soil, landscape type and irrigation patterns which cause run-off. The researchers also noted that pesticides were detected in the soil down to the deepest horizon of soil (Loewy, 2011).

A similar study was conducted in Ireland(Zhao Y. S., 2013) using GPS technology to identify pesticide use in the country and its effect on the environment and on the water supply. They found six most commonly used pesticides and the regions in which they are most heavily used. They observed that these regions were associated with the highest levels of ground water contamination due to run-off, leaching or accidental spills. It was also determined that the number of tests above the tolerance level for the European Union have been decreasing, but that continued monitoring is crucial because some pesticides are highly toxic (Zhao Y. S., 2013).

Agriculture clearly has a significant impact on our environment, from the use of pesticides, fertilizers, and the mechanical stresses such as plowing and harvesting. As caretakers for the land, farmers around the world have a responsibility to prevent soil and environmental degradation, contamination of the water supply, and loss of biodiversity by practicing sustainable farming techniques. The future of agriculture depends on the health of the environment which have harmful effects on human health.

D. Implementation of the Slow Food Model in the Community

Synthesizing all the information about local, organic, and sustainable into a thriving food system will be no simple task. However, it has the potential to fill the numerous gaps presented by the current food system. In the present, eating has become too complicated and not enough people prioritize feeding themselves well. As a result, increasing rates of diet-related diseases such as diabetes, hypertension and obesity are increasing. Additionally, a section of the population is still malnourished and experiencing dangerous deficiencies. There is a need to increase the number of citizens who have access to good, clean and fair food.The research presented about nutritional quality, chemical residues and over all holistic effect of organic and sustainable foods leads to the conclusion that this model could yield healthier citizens.

These associations can be difficult to prove quantitatively because of how varied every community is. However, positive qualitative changes can be observed in a community as a result of the changes brought by a local food system. Connor et al. (2006) argues that changes in areas such as community health, farmland preservation, and economic wellbeing can translate into an overall positive change to a local area. The researchers observe that many positive "loops" (pictured below) can be created with this systems approach, which will counteract the restrictive "loops" of the current food systems (Conner, 2006).

Figure 1

Loop 1. CFS → (+) Local Purchases → (+) Viable Farms → (+) Farmland Preservation → (−) Property Taxes → (+) Personal Income, → (+) $ for Food → (+) Support for CFS → CFS

Loop 2. CFS → (+) Access to Fruits and Vegetables → (+) Quality of Diets → (+) State of Community Health → (−) Health Care Costs (+) Health of Economy → (+) Personal Income → (+) $ for Food → (+) Support for CFS → CFS

Loop 3. CFS → (+) Local Purchases → (+) Viable Farms → (+) Farmland Preservation → (−) Sprawl → (+) Exercise → (+) State of Community Health → (−) Health Care Costs (+) Health of Economy → (+) Personal Income → (+) $ for Food → (+) Support for CFS → CFS

Loop 4. CFS → (+) Local Multipliers and Value-added → (+) Health of Economy → (+) Personal Income → (+) $ for Food → (+) Support for CFS → CFS.

Casual loops, adapted from Connor et al. (2006)
*CFS (Community-based Food System)
(+) Indicates a positive change
(-) Indicates a negative change
(Conner, 2006)

Loop 1 describes a casual pathway in which community-based food systems (CFS) increase (+) local purchases and subsequently increase the number of viable farms in a given community. This in turn leads to an increase in farmland preservation. Higher than average revenue-to-expenditure ratio of farm land, promotes fiscal balance and can lead to lower property taxes. Lower (-) property taxes lead to higher incomes for those in the community, increased money to spend on food. Customer loyalty increases dramatically in personal transactions such as those seen in CFS's and ultimately increases support for the programs (Conner, 2006).

Loop 2 shows that local food systems increase the community's access to fresh fruits and vegetables from farmers' markets, community supported agriculture (CSA) or other similar programs, and as a result the quality of diet is improved. This could increase the overall health of the community and therefore decrease the overall cost of healthcare for that community. Less money towards health care would equal more personal income and income that could be spent on food which would ultimately support the community-based food system (Conner, 2006).

Loop 3demonstrates how CFS's could increase local purchases from farmers and therefore increase the viability and preservation of those farms. It then suggests that this would decrease the sprawl in a community and as a result the

amount of exercise the citizens partake in. This could increase the overall health of the community and therefore decrease the overall cost of healthcare for that community. Less money towards health care would equal more personal income and income that could be put towards food which would ultimately support the community-based food system (Conner, 2006).

Loop 4 outlines how CFS's increase local multipliers and value added products from farmers. Similarly to loop two and three, this phenomenon could increase the overall health of the community and therefore decrease the overall cost of healthcare for that community. Less money towards health care would equal more personal income and income that could be put towards food which would ultimately support the community-based food system (Conner, 2006).

Many of the suggestion made in these models are more simplified than the actual situations they represent. The study by Connor et al. (2006) does not seek to oversimplify, but to point out areas where more attention should be focused. The purpose of these loops is to display correlations between complex mechanisms so that they might be further examined.

Support for a local food system has to ultimately come from within the community. The citizens have to be willing and able to create change (Harmon, 2006). Youth attitudestowards a local food system in terms of farmland protection, participation in local food system, hunger in the U.S., organic agriculture, and

environmental issues. The study reported that there was willingness among the youth to support the local food system, protect the community's capacity for food production, and support food assistance programs (Harmon, 2006).

The above research suggests that there are positive correlations between local food environments and health. Thisrelationship can be partially attributed to the fact that local food systems create an environment where people are aware and able to make informed decisions. Additionally, the citizens within a community have more power to affect their local surroundings by choosing to spend their money on sustainable produce and supporting their neighbors (Conner, 2006). This idea is supported by the Slow Food movement (International, 2012). The Slow Food model is a local food system, dedicated to preserving the environment, promoting health, boosting local economy and thus sustaining communities.

Conclusion

Slow Food is a movement which assists communities in building a healthy society, environment, and economy by providing a framework of information and principles. Considering all the current research that has been conducted on the various factors, which influence the nutritional value of food, it could be concluded that converting the food system to one based on Slow Food principles would yield healthy citizens. Good food has been determined to be higher in nutritional value in the form of increased phytochemical, vitamin and mineral

content as well decreased pesticide residues. Phytochemicals are produced in plants when they are under stress from pests and natural causes, it has been shown that these compounds exert a similar effect on human health. Clean food contains no harmful chemical residues from pesticides or fertilizers, which can be detrimental to health. No safe levels of residues exist because of the possible effects on health from long term exposure, physical and medical condition of the person exposed, life stage, varying types of chemicals used and their use in cocktails. Organic agriculture prohibits the use of synthetic pesticides and fertilizers and includes beneficial practices such as natural fertilizers, natural pesticides, crop rotation and biodiversity which promote environmental health. Fair food seeks to improve the economic health of the producer by supporting equal pay and working conditions for farmers. Local food environments are supported by fair food and have been proven to have a profound affect on the health of the society, the environment and the economy. Clearly, there is a vast body of research which supports these conclusions and together, they create a food system which can profoundly influence total health of communities. Communities have the power to improve their health, economy, and environment by adopting the good, clean, and fair foods depicted by the Slow Food model.

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Author's Bio

Hannah Ruhl is an aspiring nutrition professional from Lincoln, Maine. She grew up in a big house in the woods, as one of the four daughters of Steve and Jeannette Ruhl. Family is one of the most important things to her, including the family labradors, Chester and Miles. She has a passion for cooking, eating and cultivation of food. Hannah hopes to embark on a career in community nutrition centered on education and sustainable agriculture. She believes that food is a uniting factor amongst all people and that the world's problems could be fixed over a good quality meal. Her future plans also include world travel, specifically to South America and the Mediterranean.